Disc Contents Contents Search

CARBONATE HARD GROUNDS: THEIR USAGE AS STRATIGRAPHIC MARKERS AND THEIR SIGNIFICANCE IN POROSITY DEVELOPMENT IN THE LOWER CRETACEOUS EDWARDS LIMESTONE, WORD FIELD COMPLEX, LAVACA COUNTY, TEXAS.

S.P. Moore[1] and S.E. Akturk[2]

ABSTRACT

Edwards gas production at the Word Field Complex is from backreef carbonate environments associated with a broad regional arch and is anomalous along the Cretaceous Shelf Margin. Over 3000 feet of core was utilized to determine the factors controlling porosity development and to calibrate electric log responses for reservoir zonation. The depositional facies in the cores include open marine, lagoon, and island paleoenvironments. The island complex (which include beaches, tidal flats, and tidal channels) controls the distribution of the production. Numerous episodes of syndepositional exposure are recognized in the cores. The most porous zones in the sequence are below the exposure surfaces in the grainstone shoal deposits of the beach environment. The evolution and identification of these exposure surfaces is critical to understanding reservoir quality and to subdividing and correlating the Edwards into hydraulic units.

Hard grounds in the Edwards evolve during both subaerial and submarine exposure. The leaching and cementing processes below these exposure surfaces have a strong control on the distribution of porosity and permeability. The dominant porosity type is intraparticle microporosity, formed preferentially in micritic or micritized grains and in the patches of interparticle lime mud. Some microporosity later converted into moldic porosity due to leaching. The influence of these exposure surfaces on the porosity trends is significant in determining the connectivity of the reservoir.

The original fabric of each lithofacies is modified by the exposure processes. Three types of exposure surfaces are recognized in the cores by their structure, color, and texture: 1) Submarine hard grounds characterized by encrustations, borings, vertical burrows, and marine cements 2) Subaerial exposure surfaces characterized by caliche crusts and pisolites, dessication features, vadose cement, brecciation, dissolution vugs and channels, and multiple episodes of infilling and 3) Pedolithic surfaces (related to prolonged post-depositional emergent conditions) characterized by clay paleosols with caliche nodules overlying rooted caliche crusts, and occasionally red sediment-filled fissures.

The hard grounds in the Edwards Limestone are widely traceable in the Word Field Complex and form an integral part of the porosity development cycles. The correlation of the porosity trends in the cores as delineated by the hard grounds correspond to reservoir units interpreted on electric logs. The sonic porosity logs show close agreement with core measured and visual porosity estimates, while the gamma log responds to lithofacies changes. The consistent physical recognition of these hard grounds and their stratigraphic relationship to porosity trends permits their usage as field wide stratigraphic markers. The carbonate hard grounds define hydraulically connected porosity zones within the Edwards reservoir and therefore, can be utilized to better define the in-place reserves.

[1] Mobil Exploration & Producing U.S. Inc., 12450 Greenspoint, Houston, Texas 77060-1991
[2] Mobil Research and Development Corporation, P.O. Box 819047, Dallas, Texas 75381